glecting the change in Δh with ascent, which is permissible except for very high ascensional rates, the rate of loss of water during adiabatic ascent is

$$\Delta h\frac{d\rho_w}{dt}=\Delta h\frac{d\rho_w}{dT}\frac{dT}{dh}\frac{dh}{dt};$$

and with the substitution $\rho_w=e/R_wT$, in which $R_w=1.608\ R$ is the characteristic constant for water vapor and e the saturation vapor pressure, we find for a layer 100 meters thick with an ascensional rate of 1 m/sec,

$$r=780\left(\frac{ab}{T}-\frac{ae}{T^2}\right)\text{mm/hr},$$

where a is the lapse rate in °C/100 m, and b the value of de/dT in mb/°C, and in which the mean value of e (in mb) through Δh may be used. Since the second term is very small, this result does not differ appreciably from that obtained by Fulks.—*H. R. Byers.*

In the first of a series of papers by Y. Takahasi, now appearing (in the Japanese language) in the Journal of the Meteorological Society of Japan (vol. 13, pp. 453–455, 1935), the instantaneous rate of condensation at a point in adiabatically ascending saturated air is calculated, and tabulated for various pressures and temperatures, from the equation of continuity; the tabulated values, when multiplied by 36×10^9 to convert to the units employed by Fulks, are in close agreement with the values read from the above chart.

If the slope of a warm front is not uniform as assumed in the example given by Fulks, the rate of precipitation will not remain constant as the warm air moves upward over the colder air; and Ångström has pointed out [3] that the variations in the intensity of precipitation during the passage of a barometric formation may provide some indication of the structure of the fronts that are involved. He shows that if the slope of the surface of discontinuity be constant, the intensity of rainfall will be nearly uniform, but will increase slightly as the formation passes; observed intensity curves during typical front passages, however, show the rate of precipitation to be far from uniform. The shapes which Ångström is thus led to ascribe to fronts are also supported by other types of evidence.

It may be pointed out that the values of de/dT required for the construction of the diagram could have been obtained with equal accuracy and with much less time and labor by simple numerical differentiation of existing tables of vapor pressures (e. g., with Newton's formula) instead of by the method which Fulks describes.—*Edgar W. Woolard.*

[3] Anders Ångström. Die Variation der Niederschlagsintensität bei der Passage von Regengebieten und einige Folgen betreffs der Struktur der Fronten. Met. Zeit., 47: 177–181, 1930.

THE CARIBBEAN HURRICANE OF OCTOBER 19–26, 1935

By W. F. McDONALD

[Weather Bureau, Washington, November 1935]

A tropical cyclone formed between October 17 and 19, 1935, in the western Caribbean Sea, and moved over an unprecedented track which carried the center first northeastward past Jamaica, then in a reverse curve westward near the south coast of Cuba, and finally southwestward to pass inland as a destructive storm over Honduras.

This hurricane was unusual also in another respect; it produced one of the major disasters of West Indian history, causing life losses estimated at perhaps as many as 2,000, without at any time giving evidence of exceptional violence insofar as available wind and barometer observations from ships or land stations along its course are concerned. The losses and damage occurred almost entirely on land areas where the storm winds, impinging on mountainous elevations, produced torrential rains and devastating floods.

As early as the morning of October 17 there was some evidence of a wide-spread but weak cyclonic wind system in the southwestern Caribbean Sea, between Jamaica and Panama. At the same time, a strong anticyclone was centered over the Middle Atlantic States and extended as far eastward as Bermuda and southward to the Florida Straits. Moderate to fresh northerly to easterly gales were reported from October 16 to 19 by ships in several localities northward from the West Indies.

The persistent southward drift of cooler air of continental origin, as high-pressure systems continued to dominate the western Atlantic from October 17 to 22, seems to have been a contributing influence in the further development of the weak cyclone over the western Caribbean, and almost certainly determined the unusual loop backward from the normal course when the center reached the southeast coast of Cuba. The synoptic situation over the North Atlantic on October 18 is shown on chart IX.

The development of this storm first became quite evident on the afternoon of October 19, when the American steamer *Forbes Hauptmann* experienced a south-southwest gale of force 9, with barometer 29.64 inches, near 13° N., 79° W. This report was received by mail and not by radio, and it was not until the next day that ships' radio reports revealed the increased intensity of the storm. The first of these observations was received from the U. S. S. *Chaumont*, on the morning of the 20th, then near 15° N., 77° W., whence she reported south-southeast wind of force 7, and barometer reading 29.68 inches. Twelve hours later the northeastward direction of progression of the disturbance had been determined, and the first advisory warnings of the developing hurricane were issued by the forecast center at Jacksonville, Fla.

The storm moved northeastward as forecast, and the center passed close to Navassa Island during the afternoon of October 21; but the path was even then beginning to deviate northward, and soon thereafter took a more northwesterly direction that brought the center to the coast of Cuba near Santiago, on the early morning of October 22.

Torrential rains over extreme southwestern Haiti attended the storm's passage, and press reports indicated a disastrous total of deaths, the actual number being uncertain but more than 1,000 and possibly as many as 2,000. There was much damage to crops and property in Jamaica, the estimates of monetary losses exceeding \$2,000,000. An unidentified schooner and its entire crew were lost off Port Antonio, on the northeast coast, but no other report of deaths from this hurricane has been received from Jamaica.

There was considerable damage in the vicinity of Santiago, Cuba, as the cyclone moved into that region, and press reports indicate that four lives were lost there. The wind exceeded 70 miles per hour at Santiago, as measured by an anemometer on a Pan-American Airways hangar which was blown down after that velocity had been recorded. Whole gale and storm winds occurred on the opposite coast of Cuba near Nipe Bay (due north of Santiago), and also eastward from Santiago as far as Guantanamo Bay where there was minor storm damage.

The hurricane center was undoubtedly deflected and much weakened in intensity by the Sierra Maestra Mountains, which front the coast westward from Santiago. During October 22 and 23 the disturbance moved westward and then southwestward, and it started back again across the western Carribbean Sea, to increase in intensity and resume full hurricane force before entering Honduras near Cape Gracias, on October 25.

The only ship to report a close contact with the storm during its southwestward movement over the open sea was the American steamer *Afel*, which on the morning of October 24 had the lowest barometer so far reported in connection with this hurricane, 29.18 inches, as the central calm passed over the vessel in 17°44′ N., 80°26′ W. The highest wind experienced there was only a strong gale (Beaufort 9) which came up from the southeast after passage of the calm center. The vortex was evidently deepening again at this time, after being very weak during the preceding day, but it had not attained hurricane force.

Next reports from the immediate vicinity of the storm center came on the morning of the 25th from the Honduran steamers *Contessa* and *Sinaloa*, and from the meteorological station at Cape Gracias a Dios, the latter reporting hurricane winds as the center passed nearby on the morning of October 25. The evidence at hand indicates that the storm weakened slowly after passing inland over Honduras, and curved westward along the fifteenth parallel of latitude, dying out in the interior after the 26th.

Much damage to property and banana plantations occurred in northeastern Honduras, with some lesser damage in extreme northeastern Nicaragua, mostly due to floods. About 150 lives were lost here, mainly in Honduras.

This hurricane adds another unprecedented track to the history of West Indian hurricanes. The center moved over a path about 1,400 miles in length, practically encircling the island of Jamaica in the loop along which its normal northeastward movement was reversed into an abnormal southwestward course; and it passed inland over Honduras only about 250 miles from the place, where, a week before, it had its origin.

Charts IX to XII show the synoptic situation at intervals of about 2 days during the course of this disturbance; and the complete track appears on chart XII.

A succession of comprehensive and accurate timely warnings was issued and broadcast from the hurricane forecasting center at Jacksonville to cover the progress of the disturbance from the evening of October 20 until it passed inland over Honduras, 5 days later.

LOWEST BAROMETER READING IN THE FLORIDA KEYS STORM OF SEPTEMBER 2, 1935

By W. F. McDONALD

[Weather Bureau, Washington, November 1935]

The account, in the September issue of this REVIEW, covering the hurricane that swept over the Florida Keys on Labor Day, September 2, 1935, indicated that an effort would be made to secure an accurate determination of the lowest pressure at the center of the storm, the reported value of which was uncertain because of lack of tests of the aneroid barometers from which the readings were obtained.

Through the courtesy of Capt. Iver Olson, the Weather Bureau obtained the privilege of examining and testing his aneroid barometer, which was read in the calm center of the storm. Captain Olson's boat weathered the storm by being fastened on the ways on the north side of the railroad embankment at Craig, Fla., near the north end of Long Key. This barometer was placed in the hands of Ernest Carson, official in charge of the Weather Bureau Office at Miami, Fla., with permission to forward it to Washington for testing in the Instrument Division laboratory.

The observed stand of the indicator hand at the time of lowest pressure as reported by Captain Olson, placed the reading far below the lowest value (28 inches) engraved on the dial. The point of reference was said to be the mark of 10° C. on the thermometer scale that occupies much of the space on the circumference of the dial that would correspond to pressure values of about 27.50 to 25.50 inches.

On receipt of the barometer in Washington it was noted that two points engraved on the Centigrade scale were marked "10", one representing −10° C., the other +10° C. In order to be certain which of these was the observed point of reference, a photograph of the face of the barometer was returned to Miami, with the request that Captain Olson be asked to indicate the proper point of reference. This photograph was returned, with certificates from Captain Olson and R. W. Craig, both of whom verified the +10° mark on the Centigrade scale as the point to which the barometer fell.

Careful laboratory tests of this barometer showed it to be an exceptionally responsive and reliable instrument. The pressure reading by a mercurial manometer, corresponding to the certified position of the barometer needle at the center of the storm on September 2, 1935, was found to be 26.35 inches, which definitely constitutes a new low record for sea-level pressures observed in the Western Hemisphere.

This is, in fact, the second lowest reading in world records, being surpassed only by the observation of 26.185, reported by the Dutch steamship *Sapoeraea* in a typhoon about 460 miles east of Luzon, August 18, 1927. The previous lowest reading for the Western Hemisphere was 27.01 inches, in the Caribbean hurricane of November 5, 1932, reported by the British steamship *Phemius*. Both of these readings were obtained from mercurial barometers. The previous lowest reading for the United States was 27.45 inches, at West Palm Beach, Fla., September 16, 1928, obtained from a barograph record.

The new low-pressure record of 26.35 inches for West Indian hurricanes, set in the Florida Keys on September 2, 1935, probably will stand unbroken for many years to come, inasmuch as it is so greatly below the previous minimum for the American area.